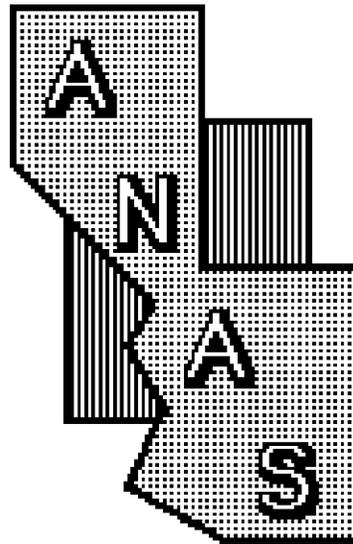


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**PROCEEDINGS
OF THE
ARIZONA-NEVADA
ACADEMY OF SCIENCE**



FIFTY FOURTH ANNUAL MEETING

April 10, 2010

**Northern Arizona University
Flagstaff, AZ**

**Proceedings of the
54th Annual Meeting
of the
ARIZONA-NEVADA ACADEMY OF SCIENCES
April 10, 2010
Northern Arizona University
Flagstaff, Arizona**

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ABBREVIATED SCHEDULE AND ACTIVITY LOCATIONS

Friday, April 9

Board of Governors meeting from 6:00-9:00 PM

Sycamore Room, University Union Building,
Northern Arizona University, Flagstaff, AZ

Saturday, April 10

All section meetings on Saturday will take place in the Adel Mathematics building on the campus of Northern Arizona University, Flagstaff, AZ.

7:00-8:30 AM	Registration: Lobby
8:00-10:00	Paper Sessions: See section schedule
10:00-10:30	Coffee Break and Poster Session: Lobby
10:00-11:30	Paper Sessions: See section schedule
11:30-1:30	Annual ANAS Awards Luncheon and Annual Business Meeting: Havasupai Room, University Union building

SUMMARY OF SECTION MEETINGS

Section	Time	Room
Biology	8:00	162
Chemistry/Mathematics/Psychology	8:30	164
Geology	8:45	163
Hydrology	8:15	205
Poster Session	10:00	Lobby

All rooms are in the Adel Mathematics Building.

SPONSORS

The Academy would like to thank following people for their generous contributions to the annual meeting.

DR. LAURA HUENNEKE, Vice President for Research, Northern Arizona University

DR. JANET MCSHANE, Chair, Department of Mathematics and Statistics, Northern Arizona University

DR. JIM ALLEN, Executive Director, School of Forestry, Northern Arizona University

DR. PAUL W. JAGODZINSKI, Dean, College of Engineering, Forestry and Natural Sciences, Northern Arizona University

LUNCHEON SPEAKER

DR. DAVID GILLETTE

"Therizinosaur: Mystery of the Sickle Claw Dinosaur"

David D. Gillette has been Colbert Curator of Paleontology at the Museum of Northern Arizona since 1998. He earned a B.S. degree in Biology from Michigan State University and a Ph.D. in Geology from Southern Methodist University. Dave has worked in museums and universities for 40 years, including faculty appointments in Geology and Biology. Some highlights of his career are: He was Distinguished Lecturer for the American Association of Petroleum Geologists. He received the James H. Shea Award, National Association of Geoscience Teachers for science writing and communications.

Dave has published more than 150 papers, one popular book (Seismosaurus, The Earth Shaker, and edited two technical books (Dinosaur Tracks and Traces and Vertebrate Paleontology in Utah.

BIOLOGY SESSION

SESSION: 8:00

ROOM 162

Chairperson: Robert Bowker

**8:00-8:15 *ELEVATED ATMOSPHERIC CARBON DIOXIDE EXPLAINS
INCREASED RADIAL GROWTH IN *PINUS EDULIS***

C. Susannah Tysor and George W. Koch (Northern Arizona University, Flagstaff, AZ) and Amy V. Whipple (Merriam-Powell Center for Environmental Research, Flagstaff, AZ)

Pinus edulis (pinyon) is a foundation tree species in the southwestern United States that has suffered widespread mortality in a recent drought. Climate envelope models for pinyon predict extirpation over most of its range by the end of the century due to climate change, but these models do not include the effects of increasing levels of atmospheric carbon dioxide ($[CO_2]$) on tree growth. Pinyon's response to precipitation and temperature may change with increasing $[CO_2]$ since it increases water use efficiency, rendering correlations between climate variables and distributions used in climate envelope models incorrect. We considered tree rings from pinyon growing recently and centuries ago. Based on the difference in radial growth rates between piñon pine growing in the 20th century and in preindustrial times, elevated $[CO_2]$ is likely responsible for recent growth rate increases. A linear model of radial tree growth with only $[CO_2]$ as a covariate successfully predicted recent pinyon growth. Based on the strong relationship between $[CO_2]$ and radial pinyon pine growth, we believe it is essential for $[CO_2]$ to be incorporated into climate envelope models to make accurate predictions for pinyon.

**8:15-8:30 *EFFECT OF GLUCOSE CONCENTRATION ON THE PRIMING
EFFECT**

Erin Romo (Northern Arizona University, Flagstaff, AZ)

Differing concentrations of universally and specifically labeled isotopic glucose respired as CO_2 will be measured weekly for a 15-week trial utilizing the Picarro cavity ringdown isotope spectrometer and the Licor infrared gas analyzer. Measurements are intended to identify patterns within the metabolic SOC (soil organic carbon) cycling process and to illustrate the initial negative priming effect in conjunction with the subsequent positive priming effect. Soil samples are to be collected solely within the grassland elevation gradient to analyze this effect, which has been repeatedly observed as a greatly fluctuating phenomena. Utilizing differently labeled isotopic glucose as markers for respiration activity within the microbial community, it is

expected that these distinctive markers will influence a change in initial negative priming, in that the specifically labeled substrate will have a lower occurrence of respiration suppression. Because of variance in the microbial metabolic pathways it may be postulated that isotopic carbon invariably and significantly impacts atmosphere CO₂ trends.

8:30-8:45 *PREVALANCE OF COXIELLA BURNETII DNA IN CONSUMER MILK FROM THE UNITED STATES

Remy E. Hilsabeck, Paul Keim (Northern Arizona University, Flagstaff, AZ)

Coxiella burnetii is an obligate intracellular pathogen common in livestock on every continent. It is easily dispersed and highly infectious, but not extremely virulent. Infected animals shed the bacterial cells in bodily fluids such as urine and milk. Despite its ubiquity, *C. burnetii* is difficult to culture and thus difficult to genotype. As a result, little is known about its geographic distribution and population structure. While the pasteurization process kills this pathogen, DNA may still be present in quantities suitable for detection and genotyping. To test this hypothesis, 10 samples of bovine milk as well as 1 sample of goat milk, originating from 11 dairy plants across five states, were purchased from local grocery stores in Flagstaff, AZ. These samples underwent crude DNA extractions that were then tested using a *C. burnetii* detection assay: IS1111. All samples tested positive for *C. burnetii* DNA, suggesting that it is widely distributed in milk in the U.S. Genotyping was performed using TaqMan dual probe assays to target single-nucleotide polymorphisms. In most cases, genotyping data were obtained and demonstrated that all samples are phylogenetically similar, suggestive of a dominant genotype in U.S. dairies. We have demonstrated that detecting and genotyping *C. burnetii* from milk is possible, allowing for more broad and detailed epidemiological studies of this pathogen in the future.

8:45-9:00 *MODELING, SYNTHESIS AND BIOLOGICAL EVALUATION OF POTENTIAL RETINOID X RECEPTOR (RXR) SELECTIVE AGONISTS FOR THE TREATMENT OF CUTANEOUS T-CELL LYMPHOMA

J.K. Furmick¹, C.E. Wagner¹, A. van der Vaart², S.L. Badshah³, P.A. Marshall¹, and P.W. Jurutka^{1,4}
(¹Arizona State University West Campus, Phoenix, AZ, ²University of South Florida, Tampa, FL, ³Arizona State University, Tempe, AZ, and ⁴University of Arizona College of Medicine in Partnership with Arizona State University, Phoenix, AZ)

Retinoids can be used clinically to treat a variety of skin disorders and cancers. An endogenous retinoid, 9-cis retinoic acid (9-cis RA), binds to the retinoid X receptor (RXR) and induces RXR homodimer formation and RXR-mediated transcription. Bexarotene (Bex) is a synthetic ligand modeled after 9-cis RA that is indicated for the treatment of cutaneous T-cell lymphoma (CTCL). Bex works by stimulating RXR homodimer formation and modulating the activity of 9-cis RA target genes, but it can also produce undesired clinical side effects by interfering with

other RXR-requiring pathways. Therefore, we sought to model and synthesize novel analogs of Bex that mediate regulation of RXR anti-tumor genes without disrupting other RXR-dependent networks. Employing two different biological assays, we tested 19 analogs of Bex and discovered three compounds that best induce RXR-mediated transcription. These three analogs also stimulate significant apoptosis in CTCL cells, and have similar or better K_i and EC_{50} values when compared to the Bex parent compound. We also evaluated Bex and the three analogs for their residual retinoic acid receptor (RAR) agonist activity employing a RARE-mediated transcriptional assay and found that these three analogs are selective RXR agonists. Based on these novel findings, we have synthesized an additional ten new halogenated compounds and preliminary data reveal four more promising analogs. The results from these approaches may lead to the discovery of novel RXR analogs that will inhibit proliferation pathways in cancer cells, and suggest that rational drug design can be employed to develop rexinoids with improved biological properties.

**9:00-9:15 PARENT/OFFSPRING INTERACTIONS IN *HELOBDELLA STAGNALIS*:
A SPECIES OF LEECH FOUND IN MONTEZUMA WELL, ARIZONA**

Rebecca K. Beresic-Perrins and Stephen M. Shuster (Northern Arizona University, Flagstaff, AZ)

The behavior of parental care is well documented in vertebrates, but poorly understood in invertebrate systems. *Helobdella stagnalis* is a common glossiphoniid leech that exhibits postzygotic parental care. Hermaphroditic adults carry their broods ventrally for an average of two weeks before juveniles become independent. When brooding, the parent ventilates young and hunts for food to present to the growing juveniles. This specialized form of parental care makes *H. stagnalis* an ideal model invertebrate to investigate kin recognition between parents and offspring. My research population is located in the thermally constant freshwater system of Montezuma Well, AZ. We collected 30 adult juvenile bearing *H. stagnalis* from Montezuma Well and investigated whether they exhibit kin recognition by documenting if detached juveniles reattached to their parent and whether disattached juveniles discriminate between parents and non-parents when reattaching. Juveniles do not appear to discriminate between kin: they fail to recognize their parent and reattach to any available adult. Future paternity analyses of the adults and offspring will measure the degree of relatedness among the collected leeches. High relatedness among the leeches could be a variable why the offspring attach to passing adults, which could not be elucidated from the behavioral experiments.

9:15-9:30 NATIVE BEE DISTRIBUTION ALONG AN ELEVATIONAL GRADIENT

Jacob Burton, (Northern Arizona University, Flagstaff, AZ), Dave Smith, (U.S. Fish and Wildlife Service, Flagstaff, AZ), and Neil Cobb, (Northern Arizona University, Flagstaff, AZ)

Both climate change and pollinator decline are recognized as important ecological issues. High elevation environments, comprising the uppermost limits of different vegetation communities, are among the most sensitive to climatic change. There is direct evidence of native pollinator decline; long-term population trends for several insect pollinators are downward. The goal of this study is to better understand climate change effects on native pollinators in these communities. The Merriam Powell Center for Environmental Research has established study plots along a 2,200 meter elevation gradient north of the San Francisco Peaks, Arizona. Research activities were conducted throughout the five life zones that occur along the elevation gradient of this area that include desert, grassland, Pinyon-Juniper woodland, Ponderosa forest, and mixed conifer forest. Native pollinator survey lines consisting of sets of blue, yellow, and white pollinator traps were established in each of the five elevation gradient study plots. We will discuss patterns of community composition, abundance, and species richness of bees with regard to several hypotheses predicting trends along elevation gradients.

9:30-9:45 A COMPARISON OF GROUND DWELLING ARTHROPOD COMMUNITY DYNAMICS IN BURNED VS. UNBURNED AREAS OF MESA VERDE NATIONAL PARK

Jacob Higgins (Northern Arizona University, Flagstaff, AZ)

This study expands upon the Mesa Verde Ground-Dwelling Arthropod Monitoring project and compares the results of that project to the results gathered from an area that recently experienced fire. The Long Mesa fire of 2002 eliminated the dominant Pinyon Juniper Woodland and it has since been replaced by grassland consisting mostly of cheatgrass and musk thistle. Our study compares the arthropod communities and looks for changes caused by this process. Arthropods were collected at 5 intervals between 2007 and 2008 using pitfall traps, sorted into morphospecies, and statistically analyzed to differentiate between the communities. We found that the arthropod community of the burned area was significantly different in abundance but not in species richness. The indicator species of these areas was also influenced by fire with a new regime of ground dwelling arthropods becoming dominant. This study was conducted at successional endpoints to determine if a monitoring project should include different forest-succession periods to fully understand any results and changes collected during the term of a monitoring project.

9:45-10:00 CHARACTERIZATION OF THE GENETIC LINEAGE OF THE NEARCTIC ANT SPECIES *BRACHYMYRMEX DEPILIS*

Ernesto I. Rodriguez, Stephen M. Shuster, Neil S. Cobb, and Tina J. Ayers (Northern Arizona University, Flagstaff, AZ)

The genus *Brachymyrmex* (Hymenoptera: Formicidae), widespread throughout the world, is currently in a state of taxonomic chaos even after numerous morphologic studies. In North America, the native *Brachymyrmex depilis* occurs in ecosystems from southern Canada to northern Mexico. We believe that several cryptic species comprise *B. depilis*, and we hope to clarify its taxonomic status via molecular analysis. We sequenced DNA of individuals from different populations from the United States; additionally, we included specimens from Hawaii and Ecuador for comparison. We used two mitochondrial primer combinations to determine the number of genetically different species in this group using PAUP* 4.0 b010 with maximum parsimony, heuristic search, branch and bound search, and 10 random addition sequences with statistical support from bootstrap analysis. Results from the sequencing of 20 specimens from Arizona, California, Florida, Massachusetts, and Ohio support our hypothesis that the currently recognized *B. depilis* complex is actually comprised of multiple species.

10:00-10:30 COFFEE BREAK/POSTER SESSION: LOBBY

10:30-10:45 TEACHING THE MITOSIS-MEIOSIS DICHOTOMY TO JUNIOR HIGH ENGLISH LANGUAGE LEARNER STUDENTS IN ARIZONA

Theodore G. Manno (San Luis Middle School, San Luis, AZ)

Mitosis and meiosis are biological processes with diametrical, fundamental differences that illustrate the basic principles of reproduction and heredity. To explain the purposes of cell division (AZ Science Standard Grade 8: S4-C02-PO1), students must understand the complexities of both processes along with their similarities and differences. However, many Arizona students are English Language Learners (ELL) and may struggle with long, wordy explanations of broad concepts that use content-specific vocabulary. In my capacity as a science instructor in an Arizona school district comprising of an overwhelming majority of ELLs, students have benefited from an instructional approach that combines direct instruction with social constructivism as well as intertwining literacy objectives (Arizona Writing Standard 8W-3-2:PO2) with content area objectives. Students learn overarching biological terms such as ‘asexual’, ‘sexual’, ‘chromosome’, ‘gene’, ‘centromere’, and ‘spindle fiber’ with a one-week vocabulary routine involving four-square Frayer models and culminating in a quiz using the sentences composed in the final square. Students also construct each phase of mitosis and meiosis using a piece of string to simulate a nuclear membrane and color-coded pipe cleaners to

simulate chromosomes, first with the help of modeling and scaffolding, then with guided independent practice. Finally, students gain literacy in the content area by writing an expository paragraph comparing mitosis and meiosis, guided by sentence frames and starter words provided by the instructor. These techniques have improved 8th grade science scores for this objective relative to those on benchmark exams from the school year's commencement.

**10:45-11:00 PAST AND FUTURE RANGE CONTRACTIONS FOR JOSHUA TREE
(*YUCCA BREVIFOLIA*)**

Kenneth L. Cole (USGS Colorado Plateau Research Station, Northern Arizona University) and Kirsten Ironside (Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ)

The future distribution of Joshua tree is projected by combining an analysis of Twentieth Century climates over its current range, future modeled climates, and paleoecological data showing its response to a past similar climate change. As climate rapidly warmed 11,700 years ago, the range of Joshua tree contracted, leaving only the populations near what had been its northernmost limit. Its ability to spread northward into new suitable habitats may have been inhibited by the somewhat earlier extinction of megafaunal dispersers, especially the Shasta Ground Sloth. We applied a model of climate suitability for Joshua tree, developed from its Twentieth Century range and climates, to future climates modeled through a set of six individual GCMs of late Twenty-first Century climate. All data were downscaled to a grid of ~4 km in order to facilitate application within this topographically complex region. All of the models project the future elimination of Joshua tree throughout most of the southern portions of its current range. Only a few populations within the current range are predicted to be sustainable. Several models project significant potential future expansion into new areas beyond the current range, but the species' historical and current rates of dispersal would seem to prevent natural expansion into these new areas. Several areas are predicted to be potential sites for relocation/assisted migration. This project demonstrates how information from paleoecology and modern ecology can be integrated in order to develop a context for understanding ongoing processes and future distributions.

**11:15-11:30 MOTIVATIONS FOR PARTICIPATION IN CONSERVATION AMONGST
FOUR COMMUNITIES IN CENTRAL AMERICA**

By Tanika Connesero and Erik Nielsen, (Northern Arizona University, Flagstaff, AZ)

Community based conservation is often considered an alternative to the protectionist paradigm. However, we do not know if or to what extent community based conservation really works or

even whether these communities are willing to take the responsibility for the conservation of natural resources. The purpose of this study is to determine what motivations and sentiments towards the responsibility of nature people hold. Four comparative case studies that included surveys were conducted in four different Central American communities, two were in Guatemala and the other two were located on the in Honduras. Preliminary results suggest that there are differences in the levels of how responsibility for the conservation of the natural world is perceived by communities. Results also show that there are differences in the motivations that people have based on the type of conservation project (reforestation vs. wildlife). Those who participated in reforestation projects had motivations that were not only utilitarian, but also included the perpetuity of the species for intrinsic values and for future generations. Those that participated in wildlife projects expressed motivations that were somewhat utilitarian, but that were due more to their sense of stewardship and the love of the project or species. We can improve our strategies and increase our chances to achieve our natural resource management goals by understanding these factors.

11:30-1:30 LUNCHEON: HAVASUPAI ROOM, UNIVERSITY UNION BULDING

CHEMISTRY/MATHEMATICS/PSYCHOLOGY SESSION

SESSION: 8:30

ROOM: 164

Chairperson: Melinda Davis

8:30-8:45 GENDER DIFFERENCES IN NARCISSISM

Steven Funk, Cyndy Soto, Michael Brower (Northern Arizona University, Flagstaff, AZ)

Some researchers believe that narcissistic characteristics are on the rise in American culture. The present study examined the relationship between narcissistic personality characteristics and self-serving behaviors. The Narcissistic Personality Inventory (NPI) and the Narcissistic Behavior Inventory were completed by 283 psychology students. We hypothesized that individuals who are high in narcissistic personality characteristics are more likely to endorse self-serving behaviors than more socially considerate and appropriate ones. These behavioral preferences are reflected in both personal relationships, civility, and academic and occupational areas. As predicted, correlations revealed that narcissistic behaviors across all situations are related to higher overall NPI scores as well as several dimensions of narcissism. Furthermore, t-tests suggested men had higher mean scores in both overall narcissism and across all of the dimensions of narcissism. Additional analysis for the men and women showed that narcissistic exhibitionism and entitlement were correlated with self-serving behaviors for both genders. While there were some similarities between men and women, they appear to engage in narcissistic behaviors for somewhat different reasons: the authority dimension of narcissism was related to narcissistic behaviors only for the men while the superiority and vanity aspects of narcissism were related to narcissistic behaviors for only women.

8:45-9:00 DO FACIAL FEATURES PREDICT COOPERATION AND GENEROSITY IN SOCIAL DILEMMAS?

*Phillip J Hall (The University of Arizona, Tucson, AZ)

This study investigated whether facial features could predict choice in social dilemmas, and the role of altruism in explaining participant behavior in these social dilemmas. One hundred twelve undergraduate students enrolled in an introductory psychology class at the University of Arizona completed a standard Trust Game (as the second player) and a Dictator Game (as the first player) with a range of endowment levels. After playing the two games, participants rated photos of their partners in the two games on trustworthiness, attractiveness and aggressiveness.

Participants also had their photos taken, and their faces were rated by a separate group of participants on trustworthiness, attractiveness and aggressiveness. The key result of the study was that rated participant trustworthiness did not predict participant behavior in these social dilemmas, although participant attractiveness did. Furthermore, partners who were rated as more trustworthy or attractive also achieved better outcomes in the two games. Finally, clear evidence of reciprocal altruism in the Trust Game, and pure altruism in the Dictator Game was observed.

9:00-9:15 INSTRUCTIONS “BLIND” PARTICIPANTS TO THEIR SURROUNDINGS

*Rafael A. Garcia and W. J. Jacobs (The University of Arizona, Tucson, AZ)

Eighty-four participants (Ps) navigated through a computer-generated space (CG-Arena) to find a fixed, invisible target (FIT) on the maze floor. Ps in the Acquisition (A) group received no instructions directing them to the FIT location. Ps in the A+ group received instructions directing them to the location of the FIT. Ps in the A- group received instructions indicating that the FIT moved each trial. Ps in the Blank (B) group located the FIT in a room with no defining features. After training, Ps attempted to identify ‘icons’ that were and were not in the room and indicated their confidence in their choices. They then received puzzle ‘pieces’ representing the icons and reconstructed the configuration of the room as best they could. Ps in A showed a ‘normal’ acquisition curve; Ps in A+ showed little acquisition, finding the FIT immediately; both groups identified the icons and reconstructed the icon configuration accurately. Ps in A- showed little acquisition, finding the FIT only after an extensive search, as did Ps in B. Ps in A-, A, and A+ identified the icons and reconstructed the icon configuration comparably/ Ps in A- reconstructed the ‘target corner’ less well than those in A or A+. Ps in B did not identify the icons nor did they reconstruct the icon configuration accurately, though their reconstruction of the ‘target corner’ was comparable to that of A-. Probe trials (i.e. trials with no target present) demonstrated that false instructions completely ‘blocked’ learning the location of the FIT. These findings suggest that instructions may “blind” Ps to major aspects of their physical surroundings.

9:15-9:30 BIOSURFACTANT-FACILITATED DISSOLUTION OF URANIUM-OXIDES

Ciarra Greene and Jani Ingram (Northern Arizona University, Flagstaff, AZ)

Environmental contamination by heavy metals can have detrimental effects on cellular construction, often times leading to cancer, genetic mutations, and growth abnormalities. Biosurfactants are capable of chelating these heavy metals in soil and water. Rhamnolipid (JBR425) is a group of naturally occurring biosurfactants that may increase the solubility of toxic

metals; quantifying this effect is the objective of this study. By suspending uranium oxides in tap water, nanopurified water, dionized water, and a dilute rhamnolipid solution, the heavy metal concentration can be calculated. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) analysis will be used to indicate significant changes in heavy metal solubility by rhamnolipid-metal chelation. Further experiments including factors of varying pH, mineral presence, and other organic compounds in soils will be conducted. The results of this study will provide a basis for analyzing bioremediation of contaminated soil and groundwater samples from the Navajo Reservation.

9:30-9:45 HIT-AND-RUN ALGORITHMS FOR FEASIBILITY AND DETECTION OF NECESSARY LINEAR MATRIX INEQUALITY CONSTRAINTS

Shafiu Jibrin (Northern Arizona University, Flagstaff, AZ)

The talk presents modifications of three hit-and-run algorithms for detecting necessary linear matrix inequality constraints: semi definite coordinate directions algorithm (Modified SCD), original semi definite diagonal directions algorithm (Modified original SDD) and uniform semi definite diagonal directions algorithm (Modified uniform SDD). We show that these modifications are effective for finding feasible points and for detecting necessary constraints from infeasible points. We also compare the three methods on different test problems.

9:45-10:00 PERMISSIVE PARENTING, NARCISSISM, AND DEPRESSION

Steven Funk, Michael Brower, Cyndy Soto (Northern Arizona University, Flagstaff, AZ)

Scientists believe that the rate of permissive parenting is increasing. Rates of narcissistic characteristics and depressive symptoms also appear to be on the rise. This study investigated the relationships between permissive parenting, narcissism, and depressive symptoms. We hypothesized that being raised by parents who employed a permissive parenting style would increase narcissistic characteristics. Thwarted narcissism, in turn, would lead to increases in depressive symptoms. Psychology undergraduates completed an online survey that asked about their childhood experiences involving parental discipline, rules and restrictions, chores, responsibilities, attention, and involvement. They also completed the Narcissistic Personality Inventory (NPI-40), and the Zung Self-Rating Depression Scale.

10:00-10:30 COFFEE BREAK/POSTER SESSION: LOBBY

10:30-10:45 PROBABILITY AND ITS APPLICATIONS

Sooie Hoe Loke (Northern Arizona University, Flagstaff, AZ)

Probability revolves around the idea of randomness. We introduce the concept of randomness and define several important terminologies such as sample space, random variable, complement events, conditional probability, etc. Some famous probability puzzles are the Monty Hall Problem and the Birthday Problem, which could be easily interpreted in terms of probability. We then look into the application of probability in several important fields. In gambling, probability is vastly used. We discuss the house odds in several casino games and the Gambler's Ruin. In the field of insurance, a life table is an important tool, and so we explore the probability in insurance policy pricing. The new, emerging field of mathematical finance based all of its computations on probability. We investigate several topics in financial mathematics such as random walks, option pricing, and risk theory.

10:45-11:00 MENTORING MEMES IN SCIENCE: CASE STUDY OF AUSTRALIAN SCIENTISTS

Laura Gail Lunsford (The University of Arizona South, Sierra Vista, AZ)

When and how do research scientists learn to mentor? Mentoring and mentoring networks are known to be important in the development of talented research scientists. However, there is no consensus on what behaviors constitute mentoring, nor is it known when or how these practices, known as memes, are transmitted from mentor to protégé. This study focused on mentoring memes related to the preparation and education of scientists and how these memes are 'passed down' from one generation of scientists to another. Twenty-three Australian scientists were interviewed about their mentors and protégés. Findings advance the literature in two ways. First, the 'black box' of mentoring is opened to reveal a set of behaviors and practices, which will be presented in this paper. Second, mentoring memes were transmitted through emulation or compensation. Scientists who emulated their mentors reported having mentoring early in their graduate experience. Other scientists developed their mentoring practices as a way of compensating from experiencing no mentoring or bad mentoring during their graduate experience.

11:00-11:15 DUCHENNE BECKER MUSCULAR DYSTROPHY: TOWARDS STANDARD MEASUREMENT

Katalin Scherer and Mende Davis (The University of Arizona, Tucson, AZ)

Duchenne/Becker Muscular Dystrophy (DBMD) is a progressive genetic condition that affects mobility, respiration and cardiac function. Clinical trials in DBMD have investigated the effects

of treatments such as steroids, orthoses, amino acids, creatine, and respiratory muscle training. The studies have used a variety of outcomes, such as walking speed, time to wheelchair or assisted ventilation. Such outcomes are dependent on an individual's level of disease progression, and studies are often limited to individuals who have similar severity levels. It is difficult to synthesize study results from trials using diverse outcomes, and there is no method to equate across varied outcomes in DBMD. This presentation focuses on the characteristics of clinical outcomes in DBMD and the need for comparable measures across the continuum of severity.

11:30-1:40 LUNCHEON: HAVASUPAI ROOM, UNIVERSITY UNION BUILDING

GEOLOGY SESSION

SESSION: 8:45

ROOM: 163

Chairperson: Robert McCord

8:45-9:00 *PREDATION DAMAGE TO BRACHIOPODS FROM THE PENNSYLVANIAN OF ARIZONA AND NEW MEXICO

Rickey W. Bartlett and David K. Elliott (Northern Arizona University, Flagstaff, AZ)

Predation studies on marine invertebrate faunas are important in illuminating their paleoecology, however, direct evidence is rare in the fossil record and studies have mostly been carried out on shell borings as these are preserved whether the attempt is successful or not. Evidence of crushing damage is much rarer as the predated organism is usually destroyed. Some brachiopods from the Pennsylvanian Naco Fm. of Arizona and Madera Fm. of New Mexico show repaired damage that consists of paired clefts in the valves. The clefts appear to be caused by damage to the generative zone of the mantle resulting in the destruction of the cells responsible for the deposition of new shell material. This results in a very narrow zone along which no shell is produced, although shell is deposited to either side as the valves grow. This injury does not appear to be the result of environmental effects or disease as it occurs symmetrically to both valves. The most likely cause of this damage is predation attempts by a clawed or beaked predator capable of inflicting damage to both valves simultaneously. Similar damage in modern brachiopods has been attributed to crustaceans, but in the Pennsylvanian faunas the most likely culprits appear to be nautiloids or conchostracan arthropods.

9:00-9:15 *A NEW LARGE SHARK (CTENACANTHIFORMES; CHONDRICHTHYES) FROM THE PERMIAN KAIBAB FORMATION, NORTHERN ARIZONA

John-Paul M. Hodnett, David K. Elliott and Thomas J. Olsen (Northern Arizona University, Flagstaff, AZ)

A new large ctenacanth shark tooth taxon is recognized from the Permian limestones of the Kaibab Formation. Teeth of this taxon have been collected from near Sedona, Kachina Village, and Northern Arizona University main campus in Flagstaff Arizona. The teeth are separated from other 'cladodont' tooth types from the Kaibab Formation by their exceedingly large size, broad median and intermediate cusps, and the presence of serrations along the anteroposterior

margins of the main cusp. This new tooth taxon is unique in the Ctenacanthiformes in that the basolabial shelf has two rounded projections and the orolingual ridge consist of two separate buttons, similar to those seen in *Glikmanius occidentalis* (Pennsylvanian to Permian of North America and Europe). However, the median and intermediate cusps are broad and flat as in *Cladodus vanhornei* (Carboniferous of Europe). These traits are only seen together in the Kaibab taxon. The characters of a completely smooth enamel surface on the cusps and serrations on the anteroposterior margins of the main cusp are unique to the Kaibab taxon and not seen in other ctenacanthiform sharks. These traits warrant a new genus and species designation for the Kaibab taxon.

9:15-9:30 RESOLVING THE TIMING AND NATURE OF TETRAPOD FAUNAL CHANGE IN THE CHINLE FORMATION (UPPER TRIASSIC) OF PETRIFIED FOREST NATIONAL PARK

Jeffrey W. Martz and William G. Parker (Petrified Forest National Park, Petrified Forest, AZ)

Recent work in the Chinle Formation of Petrified Forest National Park is improving our understanding tetrapod faunal change during the Late Triassic. Detailed exploration has corrected several misunderstandings regarding the lithostratigraphy of the Sonsela and Petrified Forest Members, and the correlation of beds between the northern and southern regions of the park, while the continuing discovery and relocation of tetrapod localities allows an increasingly detailed and accurate biostratigraphy calibrated by new radioisotopic dates. The appearance of carbonate-rich paleosols, possibly representing the onset of increasingly arid climatic conditions during the Norian, and roughly coinciding with the Manicouagan bolide impact, can be identified within the Sonsela Member in both the northern and southern regions of the park. This shift also marks the transition between the Adamanian and Revueltian tetrapod faunas. There is little evidence of overlap between characteristic Adamanian and Revueltian faunal elements, and weak evidence for a decrease in tetrapod diversity during the Revueltian. Dinosauromorphs apparently did not become the largest land animals in western North America during the Late Triassic, so their ultimate success cannot be attributed to either competition with other tetrapods, nor to opportunism following the Manicouagan impact, which did not eliminate these competitors. However, it is possible that a later opportunistic takeover was enabled by the more extreme arid conditions of the latest Triassic-Early Jurassic.

9:30-9:45 PALEONTOLOGICAL INVESTIGATIONS IN THE ?CENOMANIAN TURNEY RANCH FORMATION, LAS CIENEGAS NATIONAL CONSERVATION AREA AND VICINITY

Robert D. McCord and Gavin McCullough (Arizona Museum of Natural History, Mesa, AZ)

Support from the Bureau of Land Management has permitted a through ongoing paleontological resource survey at the Las Cienegas National Conservation Area and vicinity. Of particular interest in this survey is the Turney Ranch Formation, consisting of sandstones and mudstones deposited in a coastal alluvial plain in the Bisbee Basin and of likely Cenomanian Age. Previously discovered vertebrate fossils are limited to fragmentary remains and the ?brachiosaur *Sonorasaurus*. Recent discoveries in the formation revealed a heretofore unsuspected wealth of petrified wood and vertebrate fossil remains at multiple stratigraphic intervals and in differing lithologies. Noteworthy recent discoveries include articulated caudals vertebrae of an ankylosaurine, a well preserved jaw of a small ornithopod, theropod teeth, turtle shell fragments and an ornithopod dorsal vertebra. Reference of the caudal vertebrae to Ankylosaurinae is confirmed by the interlocking pre and postzygapophyses in the distal caudals, and the posterior chevrons anteroposteriorly elongated and overlapping. Phylogentic assignment of the small ornithopod jaw is difficult due to its likely juvenile status and attendant ontogentic variability of characteristics.

9:45-10:00 REVIEW OF NORTH AMERICAN GLYPTODONTS IN THE CONTEXT OF NEW RESEARCH FROM SOUTH AMERICA

David D. Gillette (Museum of Northern Arizona, Flagstaff, AZ) and Richard S. White, Jr. (International Wildlife Museum, Tucson, AZ)

The basic taxonomy and paleogeography of North American glyptodonts were established in the early 1980s, with the recognition of only one genus (*Glyptotherium*) and five species ranging in age from Blancan to Rancholabrean. Since the 1980s a few new records of *Glyptotherium* have been published, including sites in Mexico and Central America. Research on glyptodonts in South America has been hampered by too many names and too many specimens, now being addressed by South American paleontologists. One persistent problem has been the recognition of ancestry of *Glyptotherium* from South American taxa. *Glyptodon* may be ancestral to *Glyptotherium*, or the two taxa might be congeneric. In that case, *Glyptodon* has priority and *Glyptotherium* would be the junior synonym. *Glyptotherium texanum*, best known from the Plio-Pleistocene “glyptodont fauna” of the 111 Ranch area of southeastern Arizona, is the smallest and least specialized species of *Glyptotherium*. Recovery of new specimens over the past decade will provide important new information concerning carapacial anatomy, range of variation within that species, and relation to the slightly younger *Glyptotherium arizonae*, which was much larger and much more derived than *G. texanum*. Recent recognition of *Glyptotherium cylindricum* in northern South America in a Late Pleistocene fauna suggests a late expansion of at least one species back into South America via the Isthmus of Panama prior to extinction.

10:00-10:30 COFFEE BREAK/POSTER SESSION: LOBBY

**10:30-10:45 TRIUMPH AND TRAGEDY IN THE EXCAVATION OF A LARGE
RHYNCHOTHERIUM FROM THE BLANCAN 111 RANCH FOSSIL
BEDS, GRAHAM COUNTY, ARIZONA**

Gavin McCullough (Arizona Museum of Natural History, Mesa, AZ)

In the autumn of 2005, BLM geologist Larry Thrasher discovered a complete skull and associated skeletal elements of the proboscidean *Rhynchotherium* in the ~ 2.5 Ma rocks known as the 111 Ranch beds of the Gila Conglomerate Formation in southeastern Arizona. The ensuing excavation was a test of will, technology, and technique for the paleontologists and crew of the AzMNH and BLM. Many of the challenges faced by the crew were not unusual for large-scale paleontological recoveries, but the unusual location and vehicular prohibitions allowed/forced the crew to test nearly every traditional excavation method used in large fossil fieldwork, with varying degrees of success. Between 2005 and 2007, semi-regular excursions were made to the *Rhynchotherium* site, and progress was made in uncovering and stabilizing the specimen. Upon reaching a point of sufficient stabilization, we began the task of preparing to move the plaster jacketed skull, the largest portion of the fossil. The first attempt included manually dragging the jacket on a repurposed car hood; the second attempt included the use of a helicopter and a fire rescue crew; the third attempt included the employment of several wildfire crewmen and All Terrain Vehicles; the fourth and final attempt included a reassessment by BLM management of vehicle impact restrictions, and the utilization of a bucket loader, an option facilitated by the BLM but not even considered by the AzMNH crew. The fossil is possibly the largest single specimen so far collected by the AzMNH.

**10:45-11:00 A SKULL AND MANDIBLE OF MAMMUT AMERICANUM
(PROBOSCIDEA, MAMMALIA) FROM SOUTHEAST ARIZONA**

Michael Pasenko (Environmental Planning Group, Phoenix, AZ)

The discovery of a skull and mandible near a zeolite mine north of Bowie provides the first description of these elements for *Mammuth americanum* from Arizona. The mastodon was prepared by Major Brady sometime before 1963 and is currently on exhibit at the Arizona Museum of Natural History. It was discovered in an area mapped as undifferentiated Pleistocene and Pliocene alluvium. Personnel from the mining operations state it came from the surficial Quaternary alluvium in the area. Underlying this alluvium are lacustrine deposits of the late Pliocene 111 Ranch beds. Previously eight localities in Arizona have reported specimens of *M. americanum*, but the Lehner Ranch site in southern Arizona provides the only description, which are teeth. The morphology of the cranium and mandible, and the zygodont condition of the molars are indistinguishable from other specimens of *M. americanum*. Although the upper tusks are not preserved, the large alveoli for them indicate this mastodon was probably a male. The small, downward deflected symphysis is a variation that has been recorded in other specimens of

M. americanum. This specimen possesses two lower tusks, which are a rarity in *M. americanum*. The presence of *M. americanum* in southeast Arizona during the Pleistocene indicates a cooler, wetter environment than modern. Mastodons are typically associated with spruce or pine dominated woodlands or parklands.

11:00-11:15 EARLY HOLOCENE VEGETATION RESPONSE TO WARMING, A GUIDE TO CURRENT AND FUTURE CHANGES

Kenneth L. Cole (USGS Colorado Plateau Research Station, Northern Arizona University, Flagstaff, AZ)

Temperatures in Arizona are projected to increase 3 to 6°C over the next 75 years. This will precipitate ecological shifts as the ranges of plant species change in response to new climates. During this shift, rapid-colonizing species should increase, while slow-colonizing species will at first decrease, but eventually become re-established in their new range. This successional process requires from 100 to 1000 years in small areas, under a stable climate, with a nearby seed source. How much longer will it require on a continental scale, under a changing climate, without a nearby seed source? This question is tested using the response of fossil plant assemblages from the Grand Canyon to the most recent rapid warming of similar magnitude. At the start of the Holocene, 11,700 years ago, temperatures increased about 4 °C over less than a century. Early-successional plant species rapidly increased, while late-successional species decreased. This shift persisted throughout the next 2,700 years. Further, two earlier, less-extreme shifts followed rapid warming events around 14,700 and 16,800 years ago. Late-successional species only predominated following 4,000 years or more of relatively stable temperature. These results have implications for conservation plans that incorporate equilibrium assumptions or reconstitute past conditions. When these concepts are extended to include the most rapid early-successional colonizers, they imply that the recent increases in invasive exotics may be only the most noticeable part of a new resurgence of early-successional vegetation and they caution against models of future carbon balance that project future conditions based upon assumptions of equilibrium within only a century.

11:15-11:30 *BIOLOGICAL PROXIES FOR UNDERSTANDING PAST CLIMATE AT PTARMIGAN LAKE, ALASKA

Mary Carson (Northern Arizona University, Flagstaff, AZ)

Arctic lakes can provide a relatively uninterrupted record of climate change. Weight percent biogenic silica (BSi) is a measure of lake diatom populations and reflects lake productivity. Total organic matter (OM) is a sum of aquatic biota and input of terrestrial biological material from the

watershed. Variability of BSi, and OM in sediment of two cores from Ptarmigan Lake in south-central Alaska was determined for the last ~3600 years. An age-depth model of the sediment was derived from ^{14}C and Pu isotopes. A wet alkaline extraction method was used to determine BSi and OM was determined through loss-on-ignition. During the instrumental period (1910-2006) OM can be correlated with January temperature ($r=0.42$), October temperature ($r=0.38$), October precipitation ($r=0.44$) from nearby Valdez, Alaska, and winter (Oct.-Mar) Aleutian Low intensity ($r=0.44$). Strong AL is generally associated with warmer wetter winters in this region possibly leading to increased spring runoff, avalanching and a greater input of terrestrial organic matter into the lake. BSi and modern climate records are not correlated, but there is a general increase in BSi during the period. OM is not consistent with other regional records of AL strength prior to the instrumental record, indicating that long-term controls on OM at Ptarmigan Lake may be different. BSi shows moderately higher values during the Medieval Warming Period (~900-1200 AD), interrupted by a decline at ~1000 AD. This period is followed by an increase in BSi at ~1450 AD. BSi then demonstrates a general decline during the Little Ice Age, LIA (~1450-1850 AD). An increase in OM during the LIA, while BSi declined, suggests that additional terrestrial influences on OM should be investigated.

11:30-1:30 LUNCHEON: HAVASUPAI ROOM, UNIVERSITY UNION BULDING

HYDROLOGY SESSION

SESSION: 8:15

ROOM: 205

Chairperson: Robert Lefevre

8:15-8:30 FIRE EFFECTS ON SOIL EROSION AND DEPOSITION ON HILLSLOPES IN THE OAK SAVANNAS: AN INITIAL ANALYSIS

Peter F. Ffolliott (University of Arizona, Tucson, AZ), Gerald J. Gottfried (U.S. Forest Service, Phoenix, Arizona), Aaron T. Kauffman, Cody L. Stropki, and Hui Chen (University of Arizona, Tucson, AZ)

Effects of cool-season and warm-season prescribed burning and a wildfire on soil erosion and deposition on hill slopes of the oak savannas in the Malpai Borderlands, an area of approximately 802,750 acres within the larger Southwestern Borderlands region, are described. Soil erosion and deposition have been analyzed separately because they represented separate processes of soil movement on a hill slope. Twelve watersheds, ranging from 20 to almost 60 acres in size, were the study areas. These watersheds, the Cascabel Watersheds, have been and continue to be the sites of a diversity of studies to evaluate the effects of fire on ecosystem resources, hydrologic functioning, and flammable fuels. Following the required calibration period, four of the watersheds were burned during the cool-season in early March 2008. Three of the four watersheds to be burned in the warm-season were (in fact) burned on May 20, 2008, with burning of the fourth watershed to be scheduled at a later date. However, wind gusts blew firebrands onto the one remaining watershed to be burned and the four control (unburned) watersheds in the following morning. The resulting wildfire crossed the boundary lines of the watersheds and then spread to burn approximately 4,000 acres. An initial analysis of the effects of the three burning events, that is, warm-season and cool-season prescribed burns and a consequent wildfire, on soil erosion and deposition is reported.

8:30-8:45 OCCURRENCE AND PRODUCTION OF AGAVE ON THE CASCABEL WATERSHEDS FOLLOWING THREE BURNING EVENTS

Peter F. Ffolliott (University of Arizona, Tucson, AZ) and Gerald J. Gottfried (U.S. Forest Service, Phoenix, AZ)

Agave (*Agave schottii*) is found mostly on rocky slopes in desert grassland and oak habitats in southern Arizona and northern Sonora. Such a habitat occurs on the Cascabel Watersheds on the eastern side of the Peloncillo Mountains in southwestern New Mexico. The Rocky Mountain Research Station, U.S. Forest Service, and its cooperators established these watersheds to

evaluate the impacts of burning on the ecological and hydrologic characteristics of the oak savannas in the region. As part of this holistic evaluation, the effects of cool-season and warm-season prescribed burning treatments and a wildfire on the occurrence and production of agave on the watersheds impacted by the burning events have been quantified. Differences among these burning events were inconsequential, and, therefore, the respective data sets for the burning events been pooled for presentation.

**8:45-9:00 SUMMARY OF A REPORT BY THE NATIONAL RESEARCH COUNCIL
ON THE HYDROLOGIC IMPACTS OF FOREST MANAGEMENT**

Peter F. Ffolliott (University of Arizona, Tucson, AZ)

At the request of the Bureau of Reclamation and the U.S. Forest Service, the Water Science and Technology Board of the National Research Council convened a committee to study and report on the presence status of forest hydrology science; connections between forest management, attendant hydrologic effects; and the consequent impacts on people. The study has been completed and the report, entitled “Hydrologic Effects of a Changing Forest Landscape,” was published by the National Academy of Science in 2008. This report is briefly summarized in this presentation.

**9:00-9:15 USING GIS TO MODEL SNOW WATER EQUIVALENTS AND
NOWPACK AUGMENTATION**

*Sam Heffelfinger (Northern Arizona University, Flagstaff, AZ)

The Purpose of this project was to explore the usefulness of GIS (ArcMAP®) in hydrology and more specifically snow water mapping. Once an accurate map could be created to model the snow-water-equivalent depths (SWE) over a specific region, the question could be posed; can weather modification, snowpack augmentation and known losses be effectively plotted and stream flows be predicted from these models?

**9:15-9:30 PATTERNS AND TRENDS IN STREAM FLOW FROM 1938 TO 1980 AT
WORKMAN CREEK, SIERRA ANCHA EXPERIMENTAL FOREST,
ARIZONA**

*Peter E. Koestner, Karen A. Koestner and Daniel G. Neary (Rocky Mountain Research Station, Flagstaff, AZ)

In 1938 the US Forest Service instrumented three watersheds on Workman Creek of the Sierra Ancha Experimental Forest in central Arizona to study the effects of manipulating mixed conifer vegetation on stream flow and sedimentation. The three watersheds were named North Fork,

Middle Fork, and South Fork. North Fork and South Fork were instrumented with 90° V notch weirs and the Main Dam was instrumented with a 90° V notch weir and a 7 ft Cipolletti weir. The flows of Middle Fork were calculated as the difference between Main Dam and the two other catchments. The objective of the treatments on North Fork was to determine the water yield increase possible from converting a mixed conifer forest into grassland. The objective of the treatments on South Fork was to determine the water yield increase achievable by converting a mixed conifer forest to a ponderosa forest. This paper will summarize the patterns and trends in stream flow measured at Main Dam from 1938 to 1980.

**9:30-9:45 FUNCTION OF RIPARIAN VEGETATION IN RETAINING SEDIMENT
IN WATERSHEDS**

Daniel G. Neary (U.S. Forest Service, Flagstaff, AZ), *Silke Buschmann (Northern Arizona University, Flagstaff, AZ) and Peter F. Ffolliott (University of Arizona, Tucson, AZ)

Riparian areas are special vegetation zones that are frequently used as buffer strips to mitigate sediment movement from upland forest and agricultural management areas. These areas are often called streamside management zones. Their size, shape, and management are governed by various combinations of economic, ecological, and regulatory factors. Riparian zones function as, and are often recognized as, important barriers or treatment areas that protect water resources from non-point source sediment. The vegetation and the geomorphic characteristics of these buffer strips produce infiltration, filtering, and deposition of sediment-laden water flowing off of intensively managed forest and agriculture lands. The effectiveness of riparian vegetation in trapping sediment depends upon the velocity of water flow, size distribution of sediments, slope and length of slope above the riparian buffer, slope and length of the buffer strip, depth of water flow into the riparian zone, vegetation characteristics such as type, density, and height. Data on sediment removal by forest vegetation buffer strips suggests that two main actions occur. First, the forest edge environment promotes sediment removal from surface runoff. Second, the sediment is sorted as it moves through lower gradient zones of the riparian buffer. This paper will examine these processes and illustrate them with examples from forest management operations and agriculture.

**9:45-10:00 COMPARISON OF RIPARIAN DATA COLLECTED ON THE
CORONADO NATIONAL FOREST 1998-99 AND 2009**

Robert E. Lefevre (U.S. Forest Service, Tucson, AZ)

Riparian areas on the Coronado National Forest have been monitored periodically since 1986. The Coronado National Forest, U.S. Forest Service has carried out this monitoring as part of the monitoring plan for the 1986 Forest Plan. As part of this monitoring, the effects of wildfire on

various riparian and channel attributes have been quantified. Changes in several attributes are presented.

10:00-10:30 COFFEE BREAK/POSTER SESSION: LOBBY

10:30-10:45 RODEO-CHEDISKI WILDFIRE: A REVIEW OF IMPACTS

Peter F. Ffolliott (University of Arizona, Tucson, AZ) and Daniel G. Neary (U.S. Forest Service, Flagstaff, AZ)

The Rodeo-Chediski Wildfire was the largest known in Arizona and the ninth largest wildfire in the United States in terms of area impacted. It damaged or destroyed ecosystem resources, disrupted hydrologic functioning, and altered the loadings of flammable fuels on much of the ponderosa pine forests exposed to the burn. An opportunity to study the impacts of the wildfire on these effects presented itself on two watersheds, one exposed to a high severity (stand replacing) fire and the other to a low severity (stand modifying) fire. This five-year study (2002 to 2007) began shortly after the cessation of the wildfire and continued through the implementation of salvage cutting and fuel reduction treatments on the watershed burned by a high severity fire. This presentation reviews the impacts of the wildfire

11:30-1:40 LUNCHEON: HAVASUPAI ROOM, UNIVERSITY UNION BUILDING

POSTER SESSION

SESSION: 10:00-10:30

ROOM: Lobby

Chairperson: Erik Gergus

EVALUATING EFFECTIVENESS OF MUSCLE ENERGY AND ARTICULATION TECHNIQUES FOR PARKINSON DISEASE

Linda-Michelle Ledesma, Jennifer Vinyard, Laura Jones, Tiffany Nunnley, Sarah Colwell, Ellecia Egloff, Gary Gailius, Steve Astengo, Bryan Smedley, Michelle Bradley, Regina Conley, Steve Culley, Tami Rollins, Jeremy Schroeder, Megan Wangh, Kyle Patrick, Shannon Scott, David Shoup, Tom O'Hare, Lori Kemper, Anthony Will, Kate Worden, William Devine, (Midwestern University, Glendale, Arizona), Warren Pettitt, and William P. Baker (Southwestern College, Phoenix, AZ)

Parkinson Disease (PD) is a progressive, chronic, neurological disorder typified by resting tremor, bradykinesia, and rigidity. Nearly one million people are affected in the US with approximately 50,000 new cases diagnosed annually. Despite availability of medication, the disease continues to have a significant impact on patient quality of life and ability to perform activities of daily living. Osteopathic Manipulative Treatment (OMT) has been shown to improve balance and gait in patients with mild to moderate Parkinson Disease. Little is known, however, on the effectiveness of OMT on overall functioning in PD. To this end, the present study investigated the effectiveness of two specific forms of OMT, Muscle Energy and Articulation, on the symptoms of PD in a randomized, single-blind, placebo-controlled study using a parallel-group design. Specifically, the question of whether certain measures of mobility and dexterity could be symptomatically improved was addressed using a randomized, single-blind, placebo-controlled design. Results elucidate the role of OMT in the treatment of symptoms of PD and contribute to the literature base on OMT.

GENOMIC ISLANDS IN *BURKHOLDERIA PSEUDOMALLEI

Jeffrey Gruendike, Apichai Tuanyok, David Wagner and Paul Keim (Northern Arizona University, Flagstaff, AZ)

Burkholderia pseudomallei is a Gram-negative bacterium and the causative agent of melioidosis, a potentially fatal disease most endemic to Southeast Asia and northern Australia. Symptoms of melioidosis are greatly diverse and predicted to be attributed in part to the genomic diversity among the many different strains. Major differences of *B. pseudomallei* genomes are associated with the mobile and unstable DNA segments located on bacterial chromosomes known as

genomic islands (GIs). Here, we describe the identification of GIs in eleven different *B. pseudomallei* genomes. The purpose of this study was to develop bioinformatics tools for identification and characterization of GIs in *B. pseudomallei*. Genomic composition analyses including %GC, dinucleotide frequency and presence of mobile genes, were used in the identification of GIs. Our study demonstrates that locations of GIs are not random as many of them are associated with tRNA loci. A total of 128 different GIs have been identified in eleven tested genomes. These GIs are differentially present or absent across 42 different genomic locations. Functional roles of most identified GIs are unknown. However, the genomic differences caused by the GIs are predicted to be one of major causes of the broad spectrum of clinical manifestations and bacterial phenotypes. Differential presence of the GIs across multiple *B. pseudomallei* strains suggests the importance of the GIs for shaping the genetic composition of individual strains and populations within this bacterial species.

DYNAMICS OF INSERTION SEQUENCE ELEMENTS IN *BURKHOLDERIA PSEUDOMALLEI

Stephanie Warrington, Jeffrey Gruendike, Andrew P. Liguori, David M. Wagner, Apichai Tuanyok and Paul Keim (Northern Arizona University, Flagstaff, AZ)

Insertion sequence (IS) elements are mobile genetic elements and are known as open sources of genetic recombination in bacteria. Particularly, *Burkholderia pseudomallei*, the causative agent of melioidosis, which is endemic in Southeast Asia and northern Australia, is one of the most genetically recombining bacterial species. Our observations have demonstrated that IS elements are major causes of genomic diversity in *B. pseudomallei* genomes. Here, we describe the dynamics of three major IS elements: *IS407A*, *ISA*, and *ISBma2* in *B. pseudomallei* populations. PCR assays were developed to study their frequency in the populations. Our study has shown that *IS407A* and *ISBma2* are common in most *B. pseudomallei* strains, whereas *ISA* is rare and only found concurrently with *IS407A*. Further observations have demonstrated that *ISBma2* has multiple copies in the genome. Quantitative real-time PCR was then used to compare the detection limit between the *ISBma2* and other conventional assays for *B. pseudomallei* diagnosis. Surprisingly, the *ISBma2* assay was highly sensitive, approximately ten times greater than other assays being compared. We believe that a better understanding of the IS elements warrants further investigations not only with regards to population genetics, but also with regards to diagnosis of melioidosis.

***QUANTIFYING YERSINIA PESTIS IN FLEAS COLLECTED FROM A PRAIRIE DOG EPIZOOTIC**

Adina Doyle, Rebecca E. Colman, Christopher J. Allender, Amy J. Vogler, W. Ryan Easterday, Ira K. Bailey, Paul Keim, and David M. Wagner (Northern Arizona University, Flagstaff, AZ)

Yersinia pestis, the causative agent of plague, naturally cycles between fleas and their rodent hosts. The classic paradigm of plague transmission involves blockage in the flea, before transmission to the host. The fleas occurring in the southwest are considered inefficient vectors because they do not form blockages. In light of new research arguing for early-phase transmission, which involves lower quantities of *Y. pestis* in the fleas, the classic paradigm must be reevaluated. Testing field collected samples for bacterial load and framing the results within the concept of early-phase transmission allows for better understanding of plague transmission during an epizootic. Our goal was to quantify the *Y. pestis* loads in individual fleas collected in Northern Arizona during an epizootic event in 2001. By examining individual loads, we can hypothesize the proportion of fleas capable of transmission, the disease burden of the system, and examine differential bacterial loads between flea species.

***VITAMIN D REGULATION OF THE EPIDERMAL DIFFERENTIATION COMPLEX TO MAINTAIN HEALTHY SKIN AND CURB INFLAMMATORY EPIDERMAL DISEASES**

EW Moffet¹, JS Patel¹, GK Whitfield¹, CA Haussler¹, J-C Hsieh¹, David Hsieh¹, PW Jurutka^{1,2} and MR Haussler¹ (¹University of Arizona, College of Medicine, Phoenix AZ, and ²Arizona State University, Phoenix, AZ)

We investigated the ability of the 1,25-dihydroxyvitamin D (1,25D)-liganded vitamin D receptor (VDR) to regulate genes within the Epidermal Differentiation Complex (EDC). This 1.7 Mb cluster on human chromosome 1q21 encodes 65 genes for skin differentiation and barrier function. Dysregulation of EDC genes is associated with inflammatory skin diseases such as psoriasis and atopic dermatitis. Microarray and real-time PCR data from cultured human epithelial tissues revealed VDR modulation of 16 EDC genes. Two additional genes are reported in the literature to be VDR-dependent, indicating that nearly 28% of EDC genes are influenced by liganded VDR. We confirmed 1,25D regulation of genes including S100A2, S100A8 and S100A9 by real time PCR. Candidate vitamin D responsive elements (VDREs) were identified and direct binding of VDR to a subset of these VDREs was demonstrated via gel mobility shift assays. These VDREs were cloned into luciferase reporter constructs to test their ability to confer 1,25D regulation in transfected keratinocytes. Given the well-documented use of 1,25D analogs in the clinical treatment of psoriasis and other skin conditions along with the incomplete nature of the data so far, we hypothesize that further regions of the EDC are regulated by 1,25D/VDR

via a novel mechanism whereby a nuclear hormone receptor exerts control over gene clusters to orchestrate coordinated bioresponses that, in the case of the EDC, maintain healthy skin.

***VITAMIN D REGULATES THE GENE EXPRESSION OF S100A2, LOCATED IN THE EPIDERMAL DIFFERENTIATION COMPLEX WITH IMPLICATIONS FOR SKIN DISEASE**

Janky S. Patel¹, Carol A. Haussler², Mark R. Haussler², and Jui-Cheng Hsieh². (¹Arizona State University, Phoenix, AZ and ²University of Arizona College of Medicine in Partnership with Arizona State University, Phoenix, AZ)

1,25-dihydroxyvitamin D (1,25D) along with its mediator, the vitamin D receptor (VDR), plays a vital role in skin health, although the genes that are regulated by 1,25D in skin are still being explored. The Epidermal Differentiation Complex (EDC), on human chromosome 1, encodes numerous genes important for skin development and maintenance, including the S100 family of proteins. S100A2, located within the EDC, is one of these genes, the expression of which is changed with skin disorders such as atopic dermatitis and psoriasis. We therefore investigated whether 1,25D and VDR were involved in the regulation of S100A2 transcription. It was found that, in the human keratinocyte line KERTr-1106, S100A2 mRNA was upregulated 1.4-fold as monitored by real time PCR. A potential VDRE with a perfect direct repeat, GGGTCAActaGGGTCA, was found and located at -2787 in the human S100A2 promoter. First, a gel mobility shift assay was employed to assess the ability of the candidate VDREs to bind to the VDR complex. The result showed that VDR bound the S100A2 VDRE as well as a positive VDRE from the rat osteocalcin gene. This candidate VDRE was then cloned into a luciferase reporter construct. Cotransfection experiments revealed that the addition of 1,25D results in a 36-fold enhancement of S100A2 VDRE-dependent transcription. These results are consistent with a role of 1,25D in regulating S100A2 expression, a novel finding that may have significance for the use of 1,25D and its analogs in the treatment of skin disorders such as psoriasis.

1,25-DIHYDROXYVITAMIN D₃ IS A NOVEL TRANSCRIPTIONAL REGULATOR OF THE ANTI-AGING GENE KLOTHO IN HUMAN AND MOUSE KIDNEY CELLS

Ryan E. Forster¹, Christine L. Lowmiller¹, G. Kerr Whitfield², Carol A. Haussler², Peter W. Jurutka^{1,2} and Mark R. Haussler² (¹Arizona State University, Phoenix, AZ; ²University of Arizona College of Medicine in Partnership with Arizona State University, Phoenix, AZ)

Klotho (*kl*) encodes a protein (Kl) that is both an anti-aging gene and a coreceptor for FGF23 to regulate bone mineral homeostasis. Whereas 1,25-dihydroxyvitamin D (1,25D) stimulates calcium and phosphate absorption in the intestine and reabsorption at the kidney, another action

of 1,25D, acting through the vitamin D receptor (VDR), is to activate the production of FGF-23, which, in a K1-dependent fashion, downregulates phosphate transporters NaPi-IIa and NaPi-IIc to decrease kidney phosphate reabsorption and prevent hyperphosphatemia. We hypothesized that 1,25D/VDR directly upregulates *kl* to optimize calcium/phosphate homeostasis and reduce aging-related illness. Real time PCR data in human proximal tubule (HK-2) and in mouse inner medullary collecting duct (IMCD3) cells revealed a modest (1.5-1.7-fold) 1,25D- and VDR-dependent upregulation of *kl* mRNA. Candidates for vitamin D responsive elements (VDREs) were identified upstream of and within the first intron of the *kl* gene. Oligonucleotides encoding these VDREs were tested in gel mobility shift assays. Several VDREs that exhibited potent binding to VDR were cloned into a pLuc-MCS luciferase reporter vector and tested for their ability to mediate transcriptional activation in response to 1,25D. Our results suggest that adequate 1,25D may not only regulate bone mineral homeostasis but may also ameliorate certain aging related phenotypes via direct upregulation of *kl*.

FINE-SCALE MAPPING OF LIFE SPAN QTL IN *DROSOPHILA MELANOGASTER

Christine L. Clark Friedman, Paul S. Keim, and Philip M. Service (Northern Arizona University, Flagstaff, AZ)

Life span in *Drosophila* has been shown to be a moderately heritable trait (Service, 2000). A long-standing selection experiment (Rose, 1984) has produced populations of flies with divergent life spans. From these populations, we produced a series of long and short-lived inbred lines. Three independent QTL mapping crosses were produced using these inbred lines. An advanced intercross line (AIL) design coupled with microsatellite markers spaced at intervals of approximately 2.5 cM was used to increase mapping resolution in the large chromosomal regions previously identified by Forbes et al. (2004). Only the extreme phenotypes, e.g. those that were short-lived and long-lived, were chosen for genotyping. This equates to approximately 12-15% from each tail of the mortality distribution. Markers were screened and AILs genotyped using PCR with a universal tail labeling method (Jay, 2004). This method allows PCR products to fluoresce for use on a capillary electrophoresis machine (i.e. AB 3730xL). The results obtained are based upon a conservative analysis using QTL Cartographer. Twelve potential QTL have been identified in our three crosses. The consistency found among our crosses gives strong support to the existence of life span QTL. Additionally, the differences identified among crosses indicate the value of multiple independent crosses in QTL analyses. QTL detected in this preliminary analysis corroborate well with the results obtained by Forbes et al. (2004).

***QUANTIFYING REPRODUCIBILITY OF MICROBIAL FINGERPRINTING USING MALDI-TOF MS: EFFECT OF AUTOMATING DATA ACQUISITION**

Susanne M. Rust and Todd R. Sandrin (Arizona State University, Glendale, AZ)

The ability to rapidly and accurately identify microorganisms is important to myriad endeavors relevant to food safety, clinical microbiology, and counter-bioterrorism. Recently, Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) has shown promise as a rapid and accurate tool to characterize microorganisms; however, effects of important components of the method, including whether data are acquired manually or in an automated fashion, have not been quantified. We investigated approaches to quantify the effect of automation on the reproducibility of this fingerprinting method. Manually acquired spectra tended to contain more peaks than those gathered in an automated fashion, but those peaks appeared more variable. Further analysis of spectra was performed using intensity-based similarity coefficients. Although automated data acquisition appears to yield higher reproducibility, further investigation is warranted to determine whether the discriminatory ability of the method is affected.

***ARE DIFFICULT-TO-CULTURE MICROORGANISMS MORE HUNGRY OR LONELY? APPLICATION OF A TISSUE CULTURE INSERT (TCI)-BASED APPROACH TO CULTIVATING MICROORGANISMS INDIGENOUS TO KARTCHNER CAVERNS, ARIZONA**

Nam K. Nguyen, Adrienne Henderson and Todd R. Sandrin (Arizona State University, Glendale, AZ)

Conventional microbiological techniques only allow for the cultivation of a small subset of microbial populations in many natural environments, including caves. A multitude of factors including nutrient and signaling molecule availability likely affect the ability of microbes to be cultivated in the lab. We used tissue culture inserts (TCIs) to facilitate flux of nutrients and signal molecules from cave soil communities into agar inoculated with microorganisms indigenous to Kartchner caverns. Greater growth (i.e., formation of microcolonies) was observed on agar plates that contained TCIs than on plates lacking TCIs. This was observed with both nutrient-rich and nutrient-limited media, suggesting that nutrient limitations did not account for the inability of some isolates to grow using traditional cultivation techniques. We are currently working to identify and characterize isolates which seemed to grow only in the presence of the soil community.

***PERSISTENCE OF INSTRUCTED BEHAVIORS**

Rafael A. Garcia and W. J. Jacobs (University of Arizona, Tucson, AZ)

Previous studies demonstrate that instructions can impair or enhance navigation to a fixed, invisible target (FIT) in a computer-generated arena (CGA: Jacobs et al, in preparation). Ninety-six participants (Ps) navigated through a CGA to find either a small- or regular-sized FIT on the arena floor. The 32 Ps in the Acquisition (A) groups received no instructions directing them to the FIT location. The 32 Ps in the A+ groups received instructions directing them to the location of the FIT. The 32 Ps in the A- groups received instructions falsely indicating that the FIT moved each trial. After training, Ps identified 'icons' that were and were not in the room and indicated their confidence in their choices. They then received puzzle 'pieces' representing the icons and used them to reconstruct the configuration of the room. Ps in A showed a 'normal' acquisition curve; Ps in A+ showed little acquisition, finding the FIT immediately; Ps in A- showed little acquisition, finding the FIT only after an extensive search. Analysis of the CGA data shows differences between A- and A+. These trends remained consistent, regardless of FIT size. Probe trials demonstrated that false instructions completely 'blocked' learning the location of the FIT. Icon recognition was comparable across all six groups. Reconstruction of the configuration of the room was comparable for all regular target groups. For small target groups, differences were found in the 'critical corner' as well as two of the wall measures. These data demonstrate instructions can leave object identification intact but disrupt spatial mapping in humans.

DETECTABLE WINDBLOWN PM-2.5 URANIUM AND OTHER TOXIC METALS IN SHIPROCK, NM

Marin S. Robinson, Yolanda B. Williams, Cristina M. Gonzalez-Maddux and Michael J. Wichman (Northern Arizona University, Flagstaff, AZ)

Uranium mining was widespread on the Navajo Reservation between 1948 and 1971. Today, over 1,000 abandoned mines remain, posing local and regional air quality concerns. Prevailing winds can disperse the mine tailings and transport them for long distances throughout the Four Corners region. To evaluate these effects, PM-2.5 concentrations (particles $\leq 2.5 \mu\text{m}$ in diameter, respectively) in windblown dust were monitored in Shiprock, NM in April and May, 2009 and November, 2009. Shiprock is located in the northeastern corner of the Navajo Reservation, due east of numerous tailings piles. PM-2.5 samples will be analyzed for 35 elements (Na through Pb) using x-ray fluorescence (XRF) and for uranium using inductively coupled plasma-mass spectrometry (ICP-MS). Particle concentrations were correlated with back trajectories of prevailing winds (HYSPLIT) and ground-level measurements of wind velocity and wind direction. XRF tests show no significant concentrations of toxic metals (Pb, As, Cr, etc.) detected in windblown PM-2.5 collected in Shiprock, NM. We further hypothesize that there will not be a significant concentration of uranium in our samples.

***HIGH-ELEVATION WET MEADOWS IN ARIZONA: HISTORICAL DISTRIBUTION, THREATS AND DECLINING BIODIVERSITY**

Karissa M. Ramstead, James A. Allen and Sharon Masek Lopez (Northern Arizona University, Flagstaff, AZ)

High-elevation (above ~2000 meters) streamside or spring-fed meadows occur in numerous locations throughout the American Southwest. They are often referred to as riparian meadows, montane meadows, sedge meadows, or wet meadows. In the past, they were often called ciénegas, but that term is now more commonly applied to mid-elevation wetlands. In this poster presentation, we cite some descriptions of high-elevation wet meadows by early European explorers of the region and present a brief summary of the major threats to wet meadow ecosystems. The main focus of the poster is on identifying species of concern that occur in Arizona's wet meadows and describing key characteristics such as their range within the state. Using the Arizona Natural Heritage Program's Heritage Data Management System as our primary source, we have so far identified fourteen plant and six animal species that occur in high-elevation wet meadows and have either federal or state protection status.

***THE CONTRIBUTION OF SPECIFIED DYADIC INTERACTION TO PARENTAL WELL-BEING**

Sarah Louise Pedrazza (University of Arizona, Tucson, AZ)

Parental well-being is a known contributor to child well-being. However, there is a dearth of literature on the relationship of parenting behaviors and parent well-being. This poster presents a critical analysis of the research streams in the literature and gaps in that literature on parenting and parent well-being. Articles with key words of parenting, well-being, dyad, behavior, and interaction from 1990 and 2010 were reviewed. The poster draws on the literature to propose a theoretical model of dyadic interactions between parent and child that influence parent well-being. A positive psychology perspective will organize a set of optimal parenting behaviors that will also be presented. The practical implications of this work will be to present recommendations to advance the literature on parent well-being.

ACADEMY BUSINESS AND ANNUAL REPORTS

OFFICERS 2009-2010

ELECTED

Robert McCord.....President
Pamela Marshall Membership Secretary
Pedro Chavez..... Permanent Secretary
Karen Conzelman Treasurer
Philip Rosen Director, Southern Arizona
Erik Gergus.....Director, Central Arizona
Shafiu Jibrin Director, Northern Arizona
Barbara Adams Director, Nevada

APPOINTED

Anthony Brazel Editor, Journal
Florence Slater Editor, Proceedings
Alison Waterkotte Science Olympiad/Science Bowl Liaison
Michael Menke Editor, Newsletter
Boris Poff Webmaster

SECTION CHAIRS

Robert BowkerBiology
Robert McCord Geology
Robert Lefevre Hydrology
Shafiu Jibrin Mathematics
Erik Gergus Posters
Melinda Davis Psychology

COMMITTEE ROSTER

BUD ELLIS SCHOLARSHIP

Stephen M. Shuster

PROGRAM

Shafiu Jibrin

MEMBERSHIP

Pamela Marshall

NECROLOGY

Pamela Marshall

OUTSTANDING SCIENCE TEACHER

William Perry Baker

BUDGET

Karen Conzelman

OUTSTANDING SERVICE AWARD

Anthony Brazel
Karen Conzelman
Betsy Cooper
Stephen Williams

BEST STUDENT PAPER

Robert McCord

GRANTS-IN-AID

Erik Gergus

BEST STUDENT POSTER

Erik Gergus

PRESIDENT'S REPORT

I am pleased to report many new projects by the Academy to better serve our membership. The Journal is receiving excellent submissions for publications, but I'd like to take this opportunity to urge you to consider submitting to the journal, and to suggest it to your students as well. Re The Journal is receiving excellent submissions for publications, but I'd like to take this opportunity to urge you to consider submitting to the journal, and to suggest it to your students as well. Remember that members receive a substantial discount for page charges. The *Journal of the Arizona Nevada Academy of Science*, and its predecessor, the *Journal of the Arizona Academy of Science* are now reaching a far greater audience through their availability on BioOne and JSTOR. We are working to increase the archive of *Proceedings of the Arizona Nevada Academy of Science* on our web site, and hope to get our hydrology publications online too. We have established an archive at Arizona State University, and are also depositing a complete set of JANAS at the Arizona Museum of Natural History library.

Membership and participation remains a concern. We are nothing without our membership. Many wait until the annual meeting to renew. From there, it's an easy thing to forget entirely! Please do so now if you have not already. Even more important, help us grow. I am firmly convinced that our number one source of new members is the recommendation of others members. It was how I was recruited, how about you? When was the last time you made such a suggestion to a student or colleague? Leadership opportunities abound in the Academy. The Academy, like all institutions must change to survive. If you are interested in joining our leadership team and making a difference, let us know!

The Fellows committee has been reformed, and by the time you read this, have presented a new slate of candidates for election. In addition, past president Owen Davis has gone through the archives and compiled a list of all our Fellows, past and present.

We continue to support the Science Olympiad, grants-in-aid to graduates, undergraduates and high school students and scholarships to high school students. I know of no other research grants available to Arizona and Nevada high school students and hope for increased interest in these.

We have an active and engaged director for Nevada now, and I hope to see increased growth, as well as a future annual meeting, there. The Academy continues to operate in the black, but to continue to do so really depends on the actions of individual members to renew, and to recruit.

Finally I like to thank our hosts for this meeting, Northern Arizona University and Shafiu Jibrin and his team for their outstanding support for these meetings.

Robert D. McCord

President

**MINUTES
OF THE ANNUAL BUSINESS MEETING
AND AWARDS LUNCHEON**

APRIL 4, 2009

The annual business meeting of the AZ NV Academy of Science was called to order at 1:25 pm in the Coyote Room of the University of Arizona's Park Student Union, by President Robert Reavis. He acknowledged and thanked the luncheon speaker, Hui Chen, graduate student in water resource management at University of Arizona, for her interesting presentation on the South to North Water Diversion Project in China, and welcomed members and guests to the meeting. He also thanked the meeting organizers, Peter Ffolliott and Cody Stropki, for their help in making the local arrangements. Other board members in attendance were: Barbara Adams, Anthony Brazel, Pedro Chavez, Karen Conzelman, Shafiu Jibrin, Pamela Marshall, Robert McCord, Michael Menke, Boris Poff,, and Florence Slater.

Reavis called attention to the Minutes of the 2008 Annual Meeting in the Proceedings and asked for corrections or additions. As there were none, it was moved and seconded that they be approved as written; the motion passed. President Reavis referred the membership to the reports of officers at the back of the Proceedings.

Next, members were asked to approve the slight changes in the By-Laws that had been distributed in the Fall Newsletter (see below -- Strikethroughs reflect deletions; **boldface** type, additions).

- 6.52 -- The Membership Secretary shall prepare and ~~mail~~ **send** notices of dues and shall keep a record of the dues paid by the members.
- 6.53 -- The Membership Secretary shall prepare and ~~mail~~ **send** renewal notices to all institutional subscribers to the Journal of the Arizona-Nevada Academy of Science and shall keep a record of fees paid.
- 8.21 -- To approve research and scholarship grants ~~make~~ **made** in the name of the Academy.
- 9.22 -- Additional nominations may ~~make~~ **made** from the floor by any regular member.

The modifications were approved.

The announcement of the individual selected by the Outstanding Service Award committee as the recipient of this year's award was made by Boris Poff. Poff introduced the 2009 recipient, Aregai Tecele and recognized Tecele not only for the accomplishments described in the Proceedings, but for getting him involved with the Academy. Tecele thanked the committee and reiterated how valuable he thought ANAS was for students, inviting non-members to join and to encourage their colleagues to get involved.

On behalf of Perry Baker, Karen Conzelman presented the teacher selected as the recipient of this year's Outstanding Middle School Teacher award, Megan Basayne-Smith of La Paloma Academy, Central in Tucson with her plaque and \$50 honorarium.

President Reavis introduced the two students selected by the judges as the Best Student Presentations. The recipients were Julie Furnick whose work described the "Biological Evaluation of Novel Bexarotene Analogs for the Treatment of Cutaneous T-cell Lymphoma," and Kevin Svancara for his research on "Molecular Cloning and Characterization of CRF-like Peptides, Receptors and Binding Protein in the Lizard, *Anolis carolinensis*." Both Julie and Kevin are students at Arizona State University and each received a \$50.00 honorarium. [Note: A third recipient was announced at the conclusion of the afternoon Hydrology session; the winner was Adam Springer, a student at the University of Arizona, whose talk was titled "Creating Resilience in Watershed Stakeholder Groups Through Social Network Analysis."]

The slate of nominees for elected officers for 2009 was announced. President Reavis called for nominations from the floor particularly for the Recording Secretary and President-Elect positions for which there were no nominees. Reavis indicated that he was willing to serve as interim recording secretary until someone else could be found. The proposed officers were approved by acclamation. They are as follows:

President: Robert McCord
President-Elect: open
Past President and (interim) Recording Secretary: Robert Reavis
Membership Secretary: Pamela Marshall
Treasurer: Karen Conzelman
Director, Nevada: Barbara Adams
Director, Northern Arizona: Shafiu Jibrin
Director, Central Arizona: Erik Gergus
Director, Southern Arizona: Phil Rosen

After announcing that next year's meeting will be held at Northern Arizona University in Flagstaff, President Reavis handed the meeting over to the new President, Robert McCord. McCord remarked on his interest in increasing involvement in the Academy, noting the absence of a lot of colleagues from the past, and that one of the goals he had for his Presidency was to draw them back into the organization as active members. He also indicated that he intended to find someone to serve as Recording Secretary soon. In the absence of any other business, the meeting was adjourned at 1:50 pm by President McCord.

Karen Conzelman

MEMBERSHIP REPORT

We currently have a total of ninety-two ANAS members that includes thirty-two dues-paying members and sixty emeritus or life members who are exempt from annual dues.

Pamela Marshall
Membership Secretary

OUTSTANDING SERVICE AWARD

NORMAN G. THOMAS

Norm Thomas served the Academy faithfully as a member of its Board of Governors from 1988-2002. He was a regional Director for those 15 years, longer than any other director has served. Norm shared regular updates on scientific developments from northern Arizona, including Lowell Observatory and NAU, in the ANAS newsletter. Thomas is noted professionally for his work at the observatory with the blink comparator. He and colleague Robert Burnham worked together at Lowell for years on a meticulous proper motion survey of the northern hemisphere. During his career, Norm discovered a number of asteroids, including the Apollo asteroids 4544 Xanthus and 4581 Asclepius and the Amor asteroid 3352 McAuliffe.

Anthony Brazel
Karen Conzelman
Betsy Cooper
W. Linn Montgomery
Milton Sommerfeld
Sandra Wardwell
Stephen Williams
Outstanding Service Award Committee

GRANTS-IN-AID RECIPIENTS

The winner of the \$300 grant for graduate research is **Nicole Cutler**. She is a student at the University of Nevada, Reno. The title of her research project is: "Sediment Phase Associations of Tungsten and the Alluvial Aquifers, Fallon, Nevada." Her research mentor is Dr. Lisa L. Stillings.

The winner of the \$200 grant for undergraduate research is **Carlos Lorenzo**. He is a student at Glendale Community College. The title of his research is: "Effect of Extracellular Lipid Concentration on *Chlamydomonas reinhardtii* Cell Growth. His research mentor is Dr. James Tuohy.

There are two winners of the \$100 grants for high school student research **Sanchay Gupta and Nicholas R. Young**. Sanchay is a student at The Meadows School in Las Vegas, Nevada. The title of his research project is: Nitrogen Dioxide Emissions from Internal Combustion Engines: Does Current Technology Reduce Emissions from Cars?" His research mentor is Dr. Robert D. Allen. Nicholas is also a student at The Meadow School in Las Vegas Nevada. The title of his research project is:"Effect of Particulate Filters on Nitrogen Dioxide Concentrations in Outdoor and Indoor Areas." His research mentor is Dr. Robert D. Allen.

Congratulations to all our winners!

Erik Gergus
Grants-In-Aid Committee

BUD ELLIS SCHOLARSHIP

The Bud Ellis Scholarship of \$1000 is offered to a graduating senior in Arizona or Nevada High Schools or Preparatory Schools. This one-year scholarship award is made to a student with an outstanding high school academic record and who intends to enter one of the institutions of higher learning in Arizona or Nevada the following year as a science or engineering major.

This year's winner is **Rachel R. Murray**. She is a member of the National Honor Society and has served as its Treasurer at her school. She is captain of the Coronado High School volleyball team and was voted to the 1st Team All City Team in 2009.

Rachel has received the enthusiastic support of her instructors and counselors and plans to attend the University of Arizona, concentrating her studies in physiology in hopes of becoming a physician.

Congratulations, **Rachel!**

Stephen Shuster
Bud Ellis Scholarship Committee

SCIENCE BOWL/SCIENCE OLYMPIAD LIAISON REPORT

After a whole day of competition in twenty-six events, it all came down to just four points. That four-point margin was all that separated Catalina Foothills High School of Tucson and Scottsdale's Desert Mountain High School in the final rankings of the 2010 Arizona Science Olympiad tournament held at Glendale Community College (GCC) on March 6, 2010. This is the third consecutive year that, Catalina Foothills HS-Blue has been the top-ranked team overall.



Catalina Foothills High School Science Olympiad Team and their coaches celebrate their first place finish

(Photo courtesy of Glendale Daily Planet)

Thirty-five teams from 28 different Arizona high schools competed in this year's tournament. They came from as far away as Teec Nos Pas, Sedona, Holbrook and Morenci as well as from Tucson and metro Phoenix itself. There were 10 "rookie" teams (those competing in their first or second state tournament) this year. In addition to recognizing the top seven teams overall and giving medals and ribbons to the top seven finishers in each of the different events, organizers distributed over \$3500 in gift certificates, cash prizes or scholarships to top finishing teams competing in the following events: Anatomy & Physiology, Astronomy, Chemistry Lab, Egg-o-Naut, Elevated Bridge, Forensics, Mission Possible, Mousetrap Vehicle, Remote Sensing, Technical Problem Solving, Trajectory, WindWatts and Write It Do It.. These awards as well as travel grants and start-up money for new teams were endowed by donations from the following

sponsors: Arizona Science Teachers Association, Employee Community Fund of Boeing, Mesa, GCC, Hickman's Family Farms, Salt River Project, and individual donors.



Science Olympiad participants ready their Mousetrap Vehicle for its heat.

(Photo courtesy of Glendale Daily Planet)

ANAS awarded \$1000 in supply money to ten teams that competed in Environmental Chemistry and Microbiology and \$100 to the top placing teams in Ecology and Ornithology in memory of ANAS leader, Bud Ellis. The following Academy members were among the 70+ volunteers who helped with the tournament: Robert Bowker, Karen Conzelman, Elizabeth Cooper, Erik Gergus, Robert Reavis, Ryan Sawby, Florence Slater, James Tuohy, and Steve Williams.

The Catalina Foothills High School team, their coaches and State Director, Agripina Paluch, will represent Arizona in the national tournament to be held this year in Champaign, Illinois in mid-May. Additional information about the Science Olympiad can be found at <http://www.gc.maricopa.edu/biology/so>

It was a busy day on campus; in addition to the 400+ students involved in the Science Olympiad, about 120 additional students from 13 schools competed in this year's Regional Science Bowl. This year's tournament saw the crowning of a new champion; BASIS Scottsdale, sailed through the preliminary rounds and soundly defeated their closest competitors, Phoenix Country Day, 70-40 in the final. Scholarships were awarded to the top four schools (3rd - BASIS Scottsdale Two, 4th Brophy Preparatory Academy). The top team will represent the state at the Department of

Energy's National Science Bowl in Washington DC at the end of April. For more information, see <http://www.wapa.gov/dsw/scibowl/>.



Team from BASIS Scottsdale took top honors in the 2010 Science Bowl.

Next year's tournaments will be held at GCC on Saturday, March 5, 2011. If Academy members, their institutions or foundations are interested in getting involved in any capacity, please contact the SO/SB liaison (Alison.Waterkotte@srpnet.com).

Alison Waterkotte
Science Olympiad/Science Bowl Liaison

**TREASURER'S REPORT
2009**

<u>Operating and Short Term Reserve Fund (Vanguard Prime Money Market Fund)</u>	
Account Value on 12/31/08	\$26,832.22
Dividend Deposits	+142.70
Account Value on 12/31/09	\$26,974.92
<u>Goethe Educational Endowment Fund (Vanguard Index 500 Mutual Fund)</u>	
Account Value on 12/31/08 (209.673 shares at \$83.09/share)	\$17,421.73
Dividends +4.957 shares Total: 209.673 shares	
Account Value on 12/31/09 (214.63 shares at \$102.67/share)	\$22,036.06
<u>General Fund</u>	
December 31, 2008 Balance	\$3,607.95
Deposits	+ 8,300.92
Expenses	- 6,118.61
Transferred to ASU General Fund	-2,000.00
December 31, 2009 Balance	\$3,790.26
<u>ASU General Fund</u>	
December 31, 2008 Balance	\$1,201.64
Transfer from General Fund	+2,000.00
Expenses	- 2,355.66
December 31, 2009 Balance	\$845.98
<u>Science Olympiad General Fund</u>	
December 31, 2008 Balance	\$56,963.83
Deposits	+16,473.34
Expenses	- 21,292.35
December 31, 2009 Balance	\$52,144.82
<u>Science Bowl General Fund</u>	
December 31, 2008 Balance	\$1,547.20
Deposits	+9,271.00
Expenses	- 3,923.57
December 31, 2009 Balance	\$6,894.63
<u>Market Value of Assets</u> (as of December 31, 2009)	\$ 107,574.57

General Funds Details

<u>Deposits</u>		<u>Expenses</u>
\$2,035.00	ANAS Membership dues	
	PayPal charges	23.41
1,131.00	Journal:	
	Subscriptions	
	Refunds	0.00
1,189.00	BioOne Royalties	
216.00	Sale of Back Issues	
1,260.00	Reprints/Page Charges	
	Printing	1,631.54
	Typing	1,500.00
	Postage	694.97
	Hydrology Proceedings	
44.57	Other	
320.35	Royalties from book	
	Web hosting fee	302.83
	Scholarships:	
	Scholarships	0.00
	Committee Expenses/Postage	0.00
	Grants-in-Aid, High School:	
	Grants	0.00
	Printing/Postage	0.00
	Grants-in-Aid, Graduate	0.00
	Grants-in-Aid, Undergraduate	0.00
	Science Olympiad awards	1,100.00
	Annual Meeting:	
2,090.00	Registration Fees	
	PayPal Charges	28.00
	Sponsor donations	
	Proceedings, Printing	584.82
	Proceedings, Postage	82.86
	Coffee Breaks	414.85
	Friday Reception	211.00
	Saturday Luncheon	1,084.28
	Meeting Rooms	437.50
	Awards	
	Outstanding Service	50.00
	Outstanding Teacher	50.00
	Printing/Postage	0.00
	Plaques	41.23
	Best Student Papers	150.00
15.00	Goethe Endowment Fund Contributions	
	AZ Corporation Commission	10.00
	NAAS Dues	0.00
	Supplies	14.00
	Postage/Office	31.25
	Printing/Office	
	Bank Charges	0.00
	Refreshments for board meetings	31.73
8,300.92	SUBTOTAL	8,474.27

<u>Deposits</u>		<u>Expenses</u>
	Science Olympiad	
132.71	Interest	
9,267.63	Sponsor donations	
6,236.00	Membership dues	2,040.000
	Tournament	
	Awards and Prizes	3,471.47
	Scholarships	0.00
	Team Travel	2,826.34
77.00	T-shirts	5,387.90
	Supplies	233.45
760.00	Lunches	1,265.52
	Coaches gifts	1,100.00
	Office Expenses	
	Copying and Postage	444.59
	Bank Charges	0.00
	Outreach	
	Workshop stipends	3,775.00
	Seed money	300.00
	Brochures/PR	100.00
	Mileage	57.68
	Travel to Nationals (State Director)	290.40
16,473.34	SUBTOTAL	21,292.35
	Science Bowl	
7,305.00	Sponsor donations	
1,966.00	School registration fees	0.00
	Scholarships	2,500.00
	Room rental fees	0.00
	Photographers	0.00
	Food	451.45
	Supplies	481.15
	Conference registration fees	120.00
	Trophies and prizes	364.97
	Online detail fee	6.00
9,271.00	SUBTOTAL	3,923.57
\$42,990.56	TOTALS	\$39,101.46

(Please note that the Science Olympiad is held in February or March of each year and this report is based on the calendar year. Some sponsorship dollars are received in the fall in anticipation of the upcoming year's tournament).

Karen Conzelman
Treasurer